UNIVERSITÄT HOHENHEIM
INSTITUT FÜR AGRARTECHNIK
Agrartechnik in den Tropen und Subtropen

Plant oil - Overview: A case study of Physic nut (*Jatropha curcas* L.)

International DAAD – Alumni Summer School

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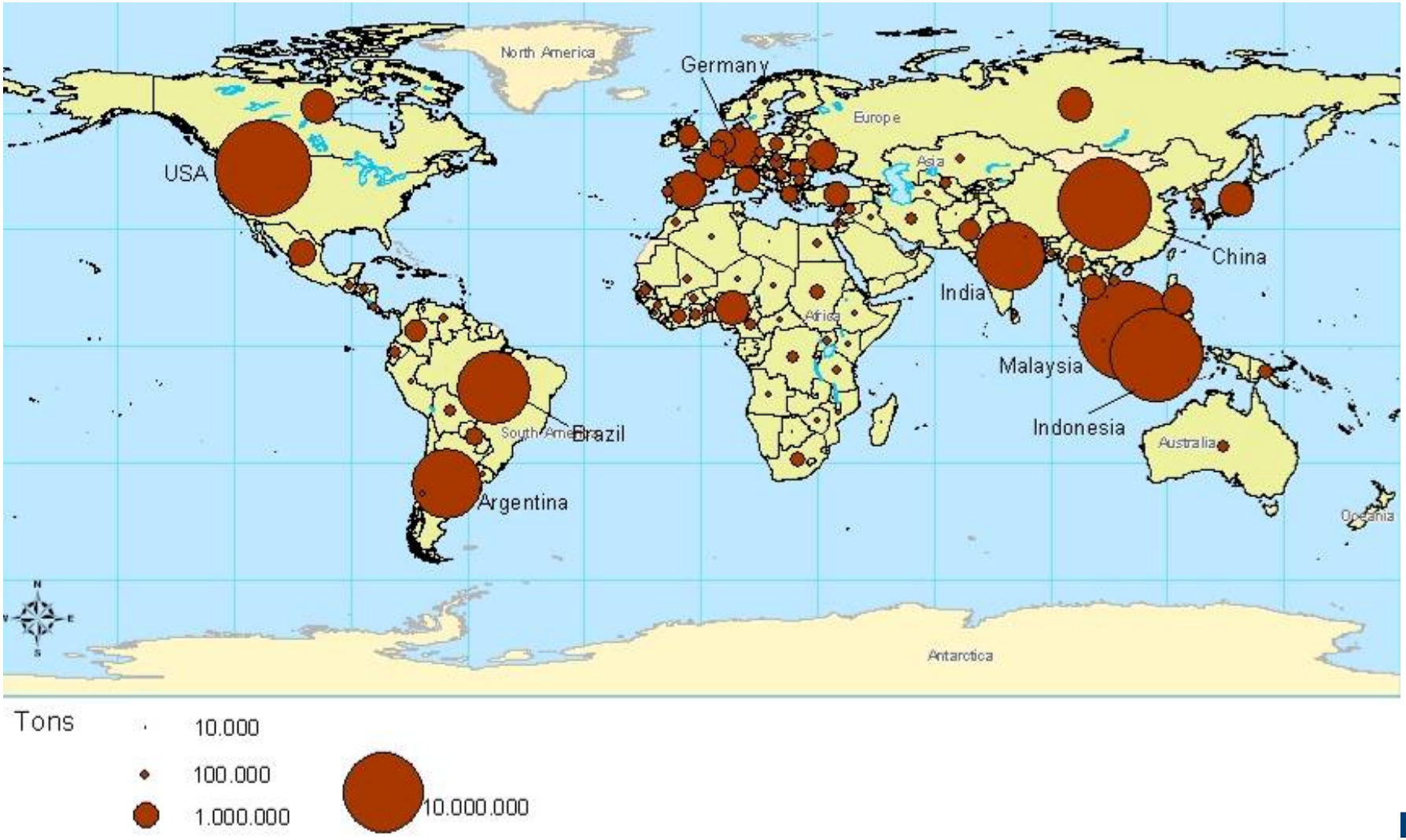
Definition of plant oil:

Oil derived from plant sources, as opposed to animal fats or petroleum.

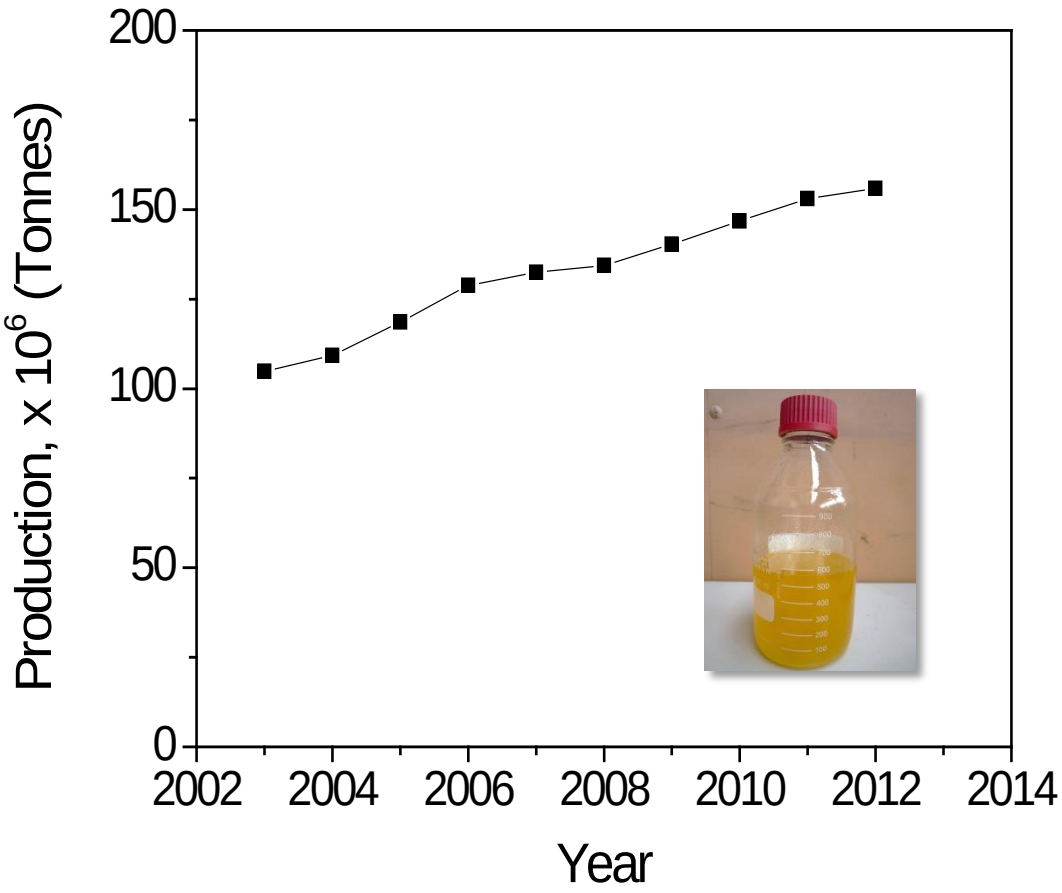
Sources of plant oil

- Palm fruit
- Soybean
- Rapeseed
- Sunflower seed
- Peanut
- Coconut
- Olive
- And many more.....

Plant Oil Production 2004

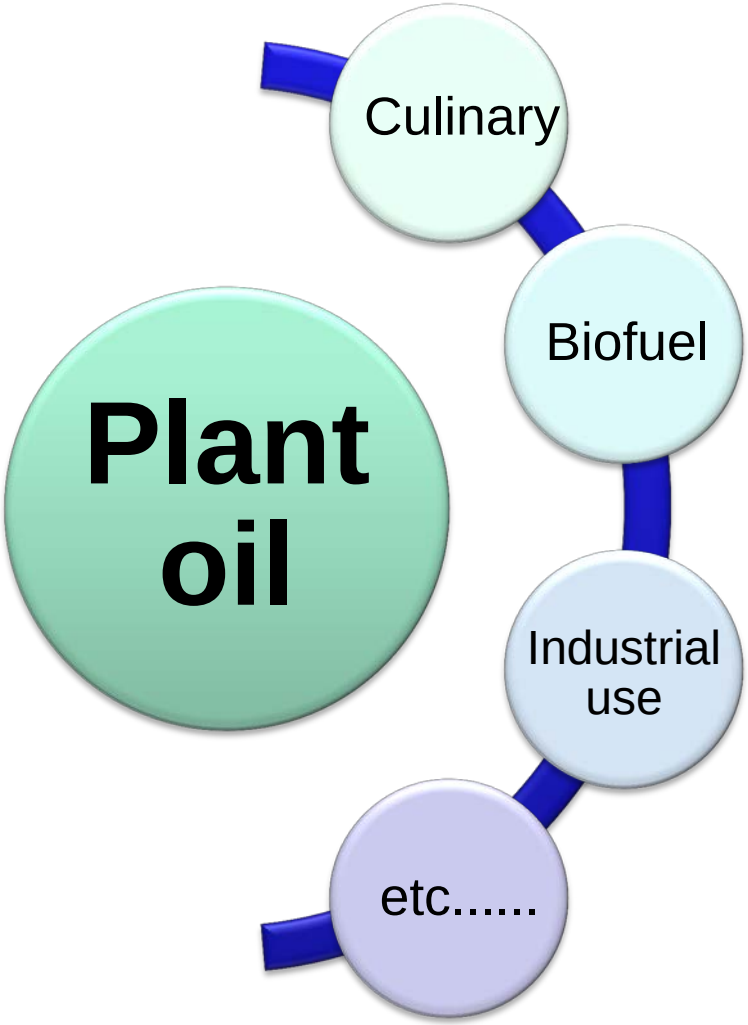


Global trend of plant oil production



Source: FAO 2013

The use of plant oil



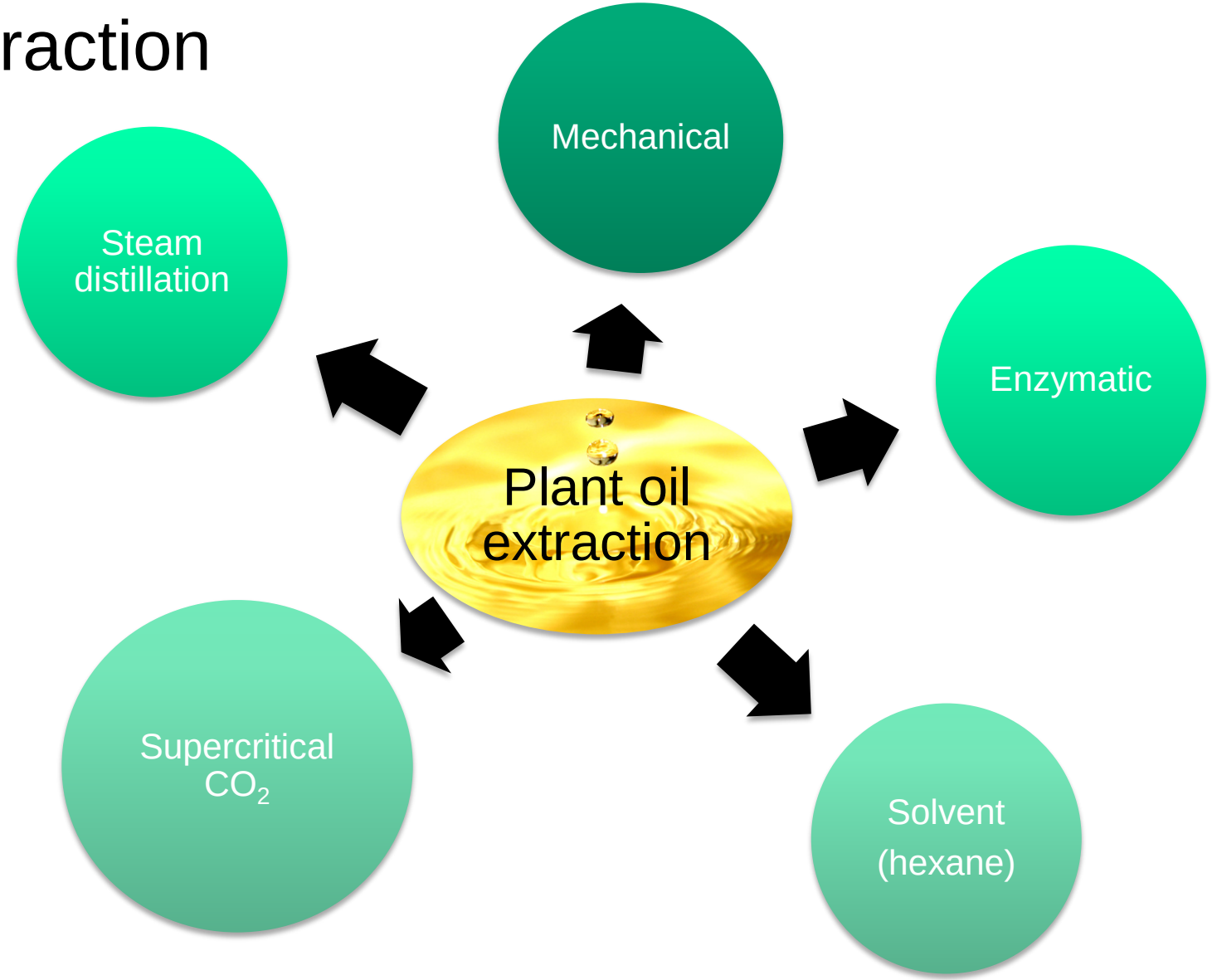
Plant oils as fuel

- Advanced technology and practical experience available
- Local fuel production
- Plant oils at ambient temperatures are suitable as fuel
- Use in modified diesel engines
- Use in plant oil cooker
- Plant oils are bio-degradable, handling is simple, low risk
- Press cake usable as fodder or fertilizer

but

- High viscosity, low cetane numbers
- Price often higher than for fossil fuels

Extraction


Mechanical
Steam distillation
Enzymatic
Plant oil extraction
Supercritical CO_2
Solvent (hexane)

Properties of plant oil quality

Physical

- Visualization
- Odor
- Water content
- .....

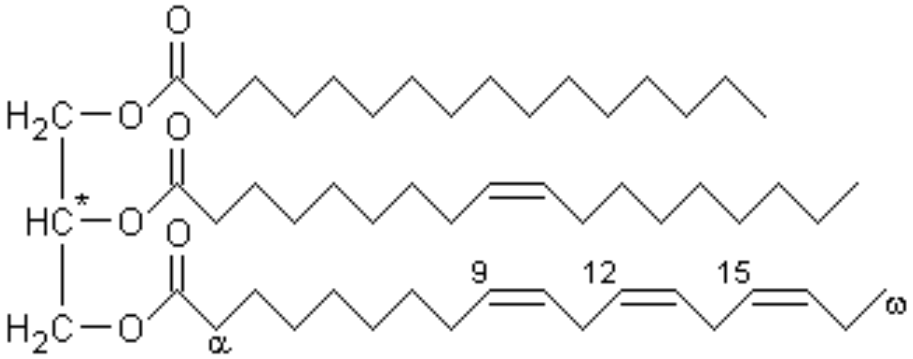
Characteristic

- Density
- Higher heating value
- Kinematic viscosity
- .....

Variable

- Acid value
- Free fatty acid
- Phosphorus
- Carbon residue
- Total contamination
- Peroxide value
- Oxidation stability
- Iodine value
- .....

Chemical properties



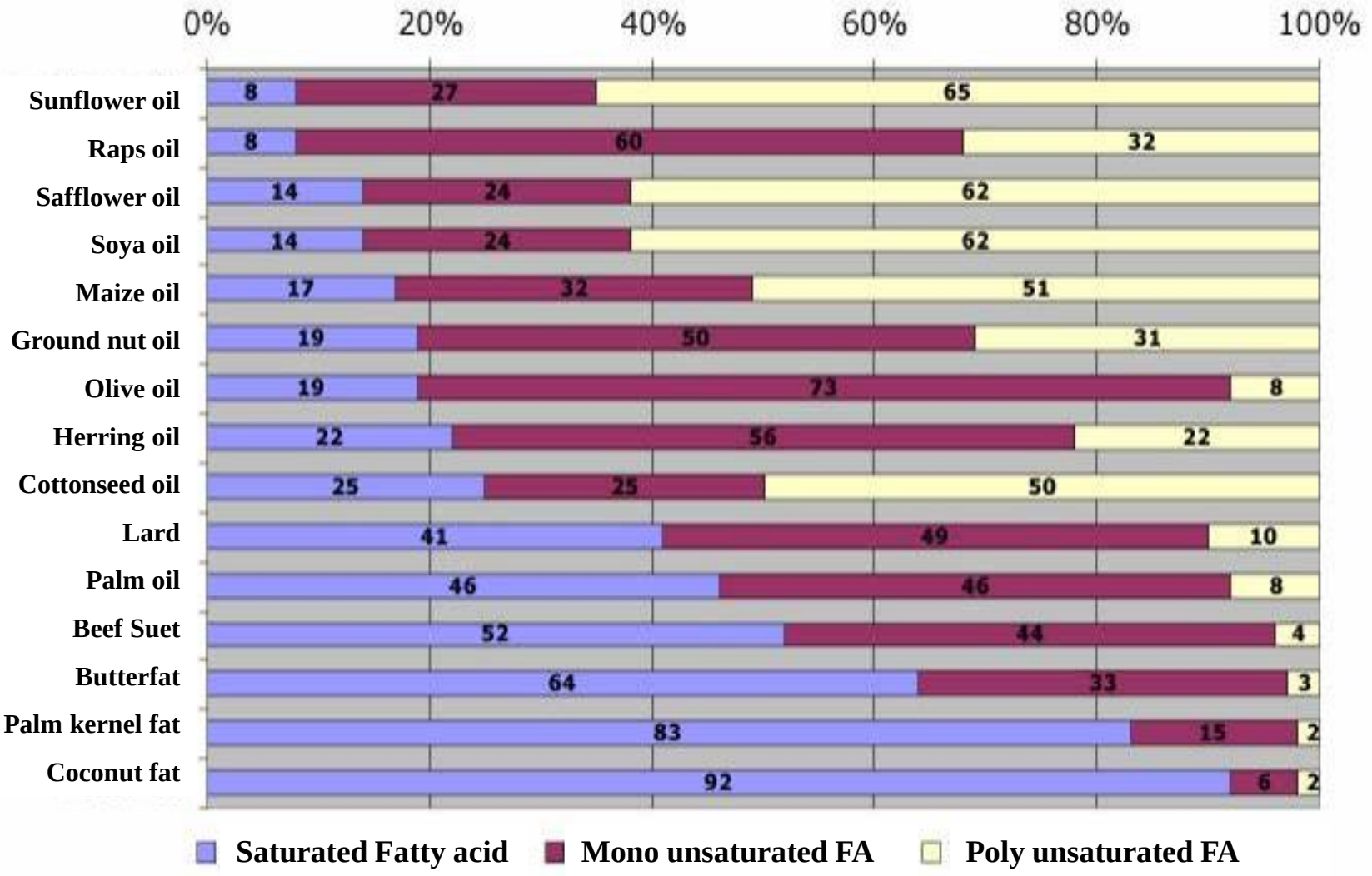
16:0

18:1

18:3

- Fatty acids:
  - saturated (no double bond)
  - mono-unsaturated (1 double bond)
  - poly-unsaturated (several double bonds)
- Triglycerides may contain a combination of different fatty acids
- Melting point of fats increases with increasing
  - length of fatty acids
  - degree of saturation of the fatty acids

Fatty Acid


0%
20%
40%
60%
80%
100%
Sunflower oil 8 27 65
Raps oil 8 60 32
Safflower oil 14 24 62
Soya oil 14 24 62
Maize oil 17 32 51
Ground nut oil 19 50 31
Olive oil 19 73 8
Herring oil 22 56 22
Cottonseed oil 25 25 50
Lard 41 49 10
Palm oil 46 46 8
Beef Suet 52 44 4
Butterfat 64 33 3
Palm kernel fat 83 15 2
Coconut fat 92 6 2
Saturated Fatty acid
Mono unsaturated FA
Poly unsaturated FA

Case Study: Physic nut (*Jatropha curcas* L.)

Jarak pagar

Saboo Dam (สบู่ดำ)

Pinhão manso

Kaatu Aamanaku

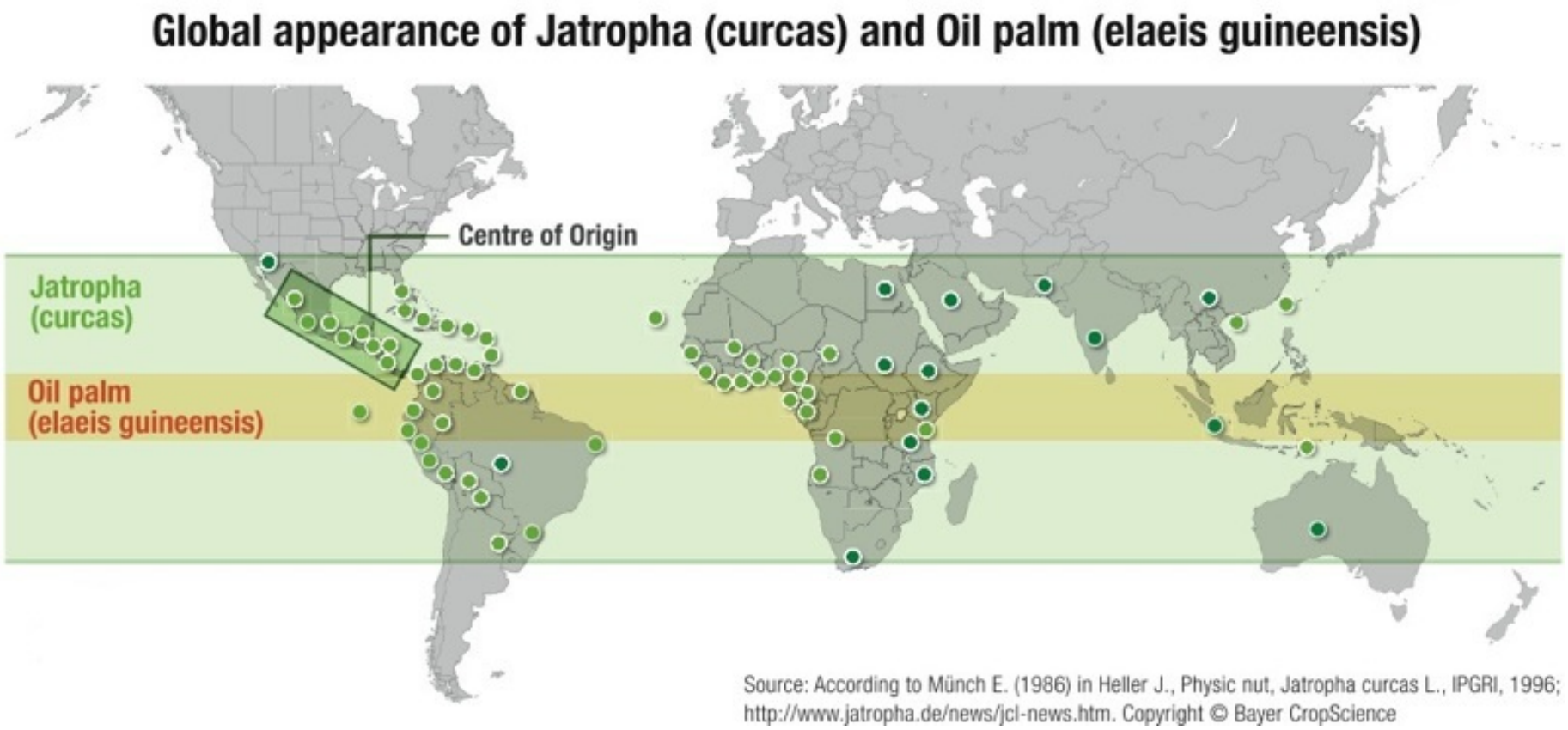
麻疯树

Lapalapa

Kocha

Ayderke

Jatropha curcas L.



Jatropha curcas L.

Fresh fruit

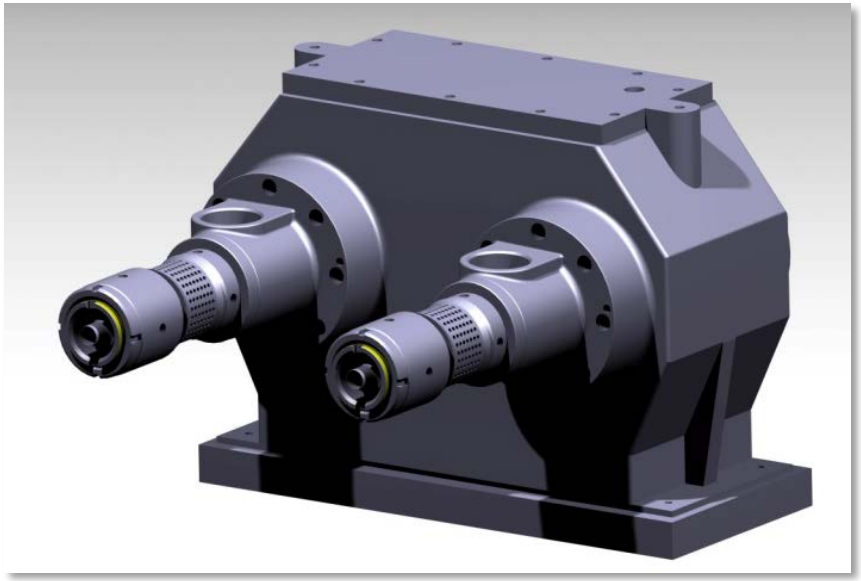
Dried fruit

Seed

Kernel

Kernel contains up to 60 % oil!

Problem and objectives



Matrix-pressing

- Additives
  - Corn
  - Rapeseed
  - Soyabeans
- Additive-percent
  - 10%
  - 20%
  - 30%

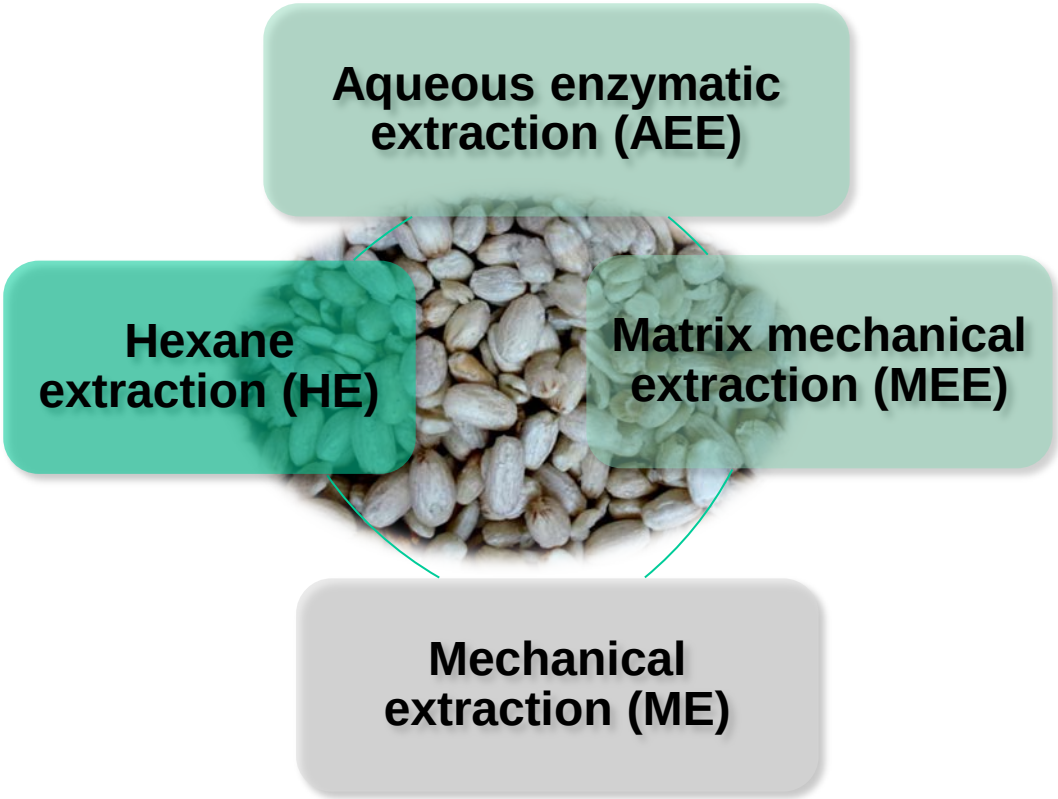
Jatropha kernel

Rapeseed

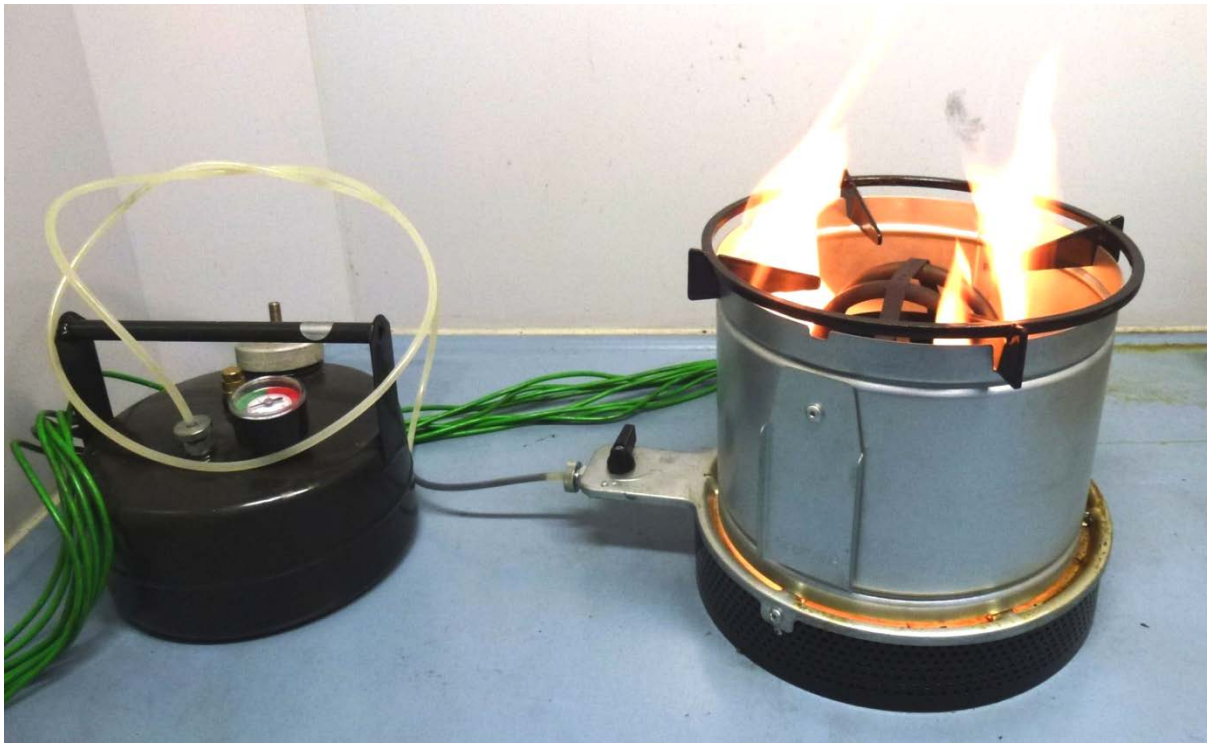
Soybean

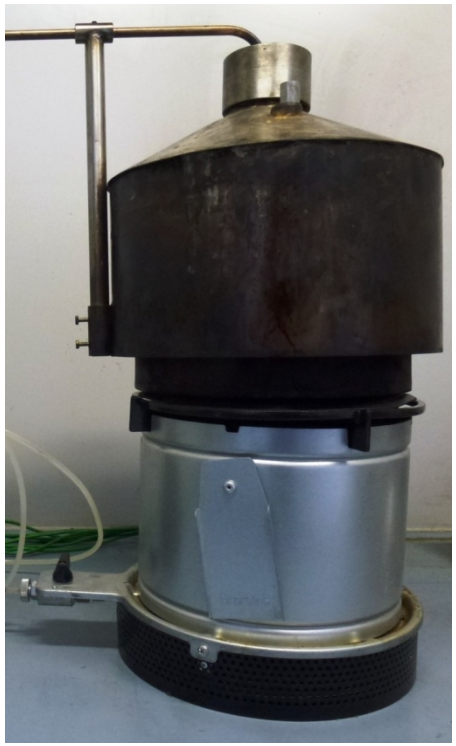
Corn

Comparison among different extractions



Plant oil stove





Plantoil stove "Protos" from BSH
Bosch und Siemens Hausgeräte GmbH, Munich

Important message

- Use of plant oil is a promising alternative.
- *Jatropha curcas* L. has a lot of potential and further studies are still needed.
- Mechanical extraction is the environment-friendly process among all the extraction techniques.
- Oil clarification is an important step to support a clean combustion process.
- Developments are still required to enhance the performance of plant oil stove.

Bundesministerium
für Bildung
und Forschung

Thank you